S4-7: Arbitrary waveform generation of current with single-electron pump

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Abstract: Generation of electric current based on a single-electron pumps is one of the promising candidates for direct primary representation of the revised SI ampere. In contrast to dc current generation with which the uncertainty is as low as sub-ppm level had already been demonstrated, generation of finite-frequency current based on a single-electron pump is still challenging. Here we have demonstrated arbitrary waveform generation of current at a sub MHz frequency range using a GaAs-based single-electron pump. In our experiment, the pump operation is digitally controlled to generate a density-modulated single-electron stream, by which arbitrary waveforms of current including sinusoidal, square, and triangular waves have been generated. Our result can open new avenues for precision measurement of electric impedance and current noise as well as demonstration of a quantum metrology triangle experiment at a finite frequency range.